

TITLE

COMPOSITE MATERIAL

Background of the Invention

5 The present invention relates to composite materials, and, especially, to composite materials suitable for use as fabrics and related materials.

10 A wide variety of articles such as fashion accessories (for example, purses, jewelry and clothing), house-ware articles (for example, place mats, runners, tablecloths and decorative frames) and packaging (for example, as a wrapping material) have historically been manufactured from fabrics such as leather, cotton, silk, and man-made fabrics (for example, rayon, composite fabrics, synthetic polymer materials etc).

15 Each of those traditional materials has certain desirable features, but each of the materials also has one or more substantial drawbacks. For example, while one material may display excellent durability, it may also be extremely susceptible to water damage. Another material may display excellent water resistance, yet also exhibit poor durability, flexibility and appearance. A great number of fabric-like manufactured materials have been developed over the years in an attempt to optimize a broad range of material properties. However, these attempts have met with only limited success.

20 Several types of composite fabric have been proposed that are formed by bonding fabrics or paper with various adhesives to achieve various effects. For example, U.S. Patent No. 4,000,343 describes a fabric made from one or more layers of creped tissue paper purportedly with the softness and drape of a woven fabric. The tissue paper used in that fabric has an extensibility of between 3% and 100% and is impregnated with vinyl resin, passed through steel rollers, and then heated.

25 US Patent No. 4,113,911 discloses a strong, cloth-like tissue laminate. This tissue laminate includes a soft creped tissue layer, similar to Kleenex. U.S. Patent No. 4,145,468 discloses a composite fabric formed by bonding together a woven or

knitted layer to a non-woven layer in such a manner that the individual fibers and fibrous bundles of the non-woven fabric penetrate into the inside of the woven fabric.

U.S. Patent Nos. 2,081,308, U.S. 2,085,473, and 2,101,874, disclose an industrial composite fabric made from corrugated paper cemented (via an asphalt material) to a backing such as burlap. A corrugated paper is used to enable stretching of the material. U.S. Patent No 2,531,931 describes a fabric made from paper web creased in two directions with cotton fibers glued to the top and bottom. That material is designed to be elastic for use in bandages, diapers, wrapping for delicate articles.

U.S. Patent No. 3,301,746 discloses an absorbent material for use in tissue, toweling, and sanitary products. U.S. Patent No. 3,862,877 describes a cloth-like tissue laminate using latex binders suitable for uses such as surgical draping, clothing, and toweling, and tenting. U.S. Patent No. 5,024,594 describes a multilayer material useful for protective clothing for personnel needing protection from toxic organic materials.

U.S. Patent No. 5,494,735 describes bonding a smooth paper to a non-woven backing to provide a composite synthetic paper that has a smooth printable surface. The paper layer can be textured by means of pressure rollers so that the pattern of the non-woven fabric appears on the surface of the paper as an embossed pattern. The synthetic paper is designed to accept offset printing.

Although numerous composite materials and methods for fabrication thereof have been developed, it remains desirable to develop improved materials and methods of fabrication that are suitable for use in a wide variety of articles and result in a variety of favorable material properties.

Summary of the Invention

In one aspect, the present invention provides composite material including at least one layer of base material. At least one inner protective layer of a flexible material is bonded on one side of the layer of base material, and at least one layer of a

bonding material is present/bonded on a second side of the base material. At least one decorative layer is bonded to the bonding material such that the bonding material is between the layer of base material and the decorative layer. At least one outer protective layer of a flexible material is bonded to the decorative layer on a side opposite the bonding material.

The base material is preferably a strong material when wetted with the bonding material. The base material can, for example, be a non-woven material or a smooth finish woven material. A woven backing can be attached to the first protective layer on a side thereof opposite the layer of base material for additional strength.

The inner protective layer preferably is at least water resistant, and, more preferably, is waterproof. Likewise, the outer protective layer is preferably at least water resistant, and, more preferably, is waterproof. Preferably, the outer protective layer is also translucent or transparent. In one embodiment, the outer protective layer includes an acrylic polymer medium. Moreover, the inner protective layer, the bonding material and outer protective layer can all include an acrylic polymer medium. In addition, to providing a waterproof, protective layer, acrylic polymer media are also oil resistant and generally stain resistant. Moreover, unlike many synthetic fabrics, the composite materials of the present invention are well suited for accepting/application of a wide variety of colorants of various color and finishes. Such colorant are, for example, mixed with or applied to the outer protective layer of acrylic polymer medium before it is dried or fixed. Colorants can also be applied to the decorative layer, intermediated binding layers (of, for example, acrylic polymer medium) or the base layer.

The decorative layer preferably includes a textured material such as a textured paper. The textured paper can, for example, include a generally random wrinkled pattern. Preferably, the decorative material is a textured material (for example, paper) having a hard finish. For example, the decorative material can be a textured paper material having a calendered finish or a plate finish. The decorative material can also be

a textured woven material having a tight weave and a hard finish. The decorative material can also be a colored or patterned material.

In another aspect, the present invention includes a method of fabricating a composite material including the steps of: bonding at least one layer of a flexible, water resistant material to one side of a layer of base material, bonding at least one decorative layer to the other side of the layer of base material, and bonding at least one outer protective layer of a flexible, water resistant material to the decorative layer on a side opposite layer of base material.

As discussed above, the decorative layer preferably includes a textured material. The flexible, water resistant material bonded to the layer of base material can, for example, be an acrylic polymer medium. Likewise, the decorative layer can be bonded to the layer of base material using an acrylic polymer medium. As discussed above, the outer protective layer is preferably translucent and can also be formed from an acrylic polymer medium.

The present invention thus provides a composite or specialty material that can, for example, be used in the manner of traditional fabrics, but is generally water-resistant (and, preferably, waterproof), durable, easy to manufacture, easy to clean and otherwise easy to maintain. Moreover, the composite materials of the present invention do not fray (largely as a result of the surrounding protective layers and/or intermediated bonding layers), so edges do not have to be finished, saving time and money in the production process. Furthermore, the composite materials of the present invention do not readily absorb dirt or oil. The composite materials can also be easily repaired with additional layers of, for example, a transparent bonding medium such as acrylic polymer medium, non-woven fabric, calendar or plate finish tissue paper or other decorative fabric(s), and colorants such as inks and paints.

The composite materials of the present invention can provide the appearance of leather but do not use animal hide. The composite materials of the present invention can also be made with environmentally friendly recycled fabrics and papers,

Indeed, tears and wrinkles can add desirable textural characteristics and colors and designs can enhance fabric decoration design.

No currently available materials exhibit all of the advantages of the composite material of the present invention. The desirable features of the composite fabric or material of the present invention enable its use in many articles including, but not limited to, fashion accessories, clothing, house-ware articles, runners, tablecloths, decorative article, and packaging.

The composite material of the present invention can be made with an aesthetically pleasing textured/designer appearance that is unique while also being easily mass-producible and quite inexpensive. Although the composite materials and methods of fabrication thereof of the present invention are well suited for commercial mass production, they are equally well suited for home use by individuals. The steps of the methods of fabrication of the present invention are easily understood and, thereafter, performed by persons without special skills in the fabric, paper or other material arts. Moreover, suitable materials used are readily available and safe to use.

The composite material of the present invention, for example, enables combination of desirable physical characteristics with the style of a hand-painted design, providing a unique appearance. The decorative layer(s) and coloring(s) of the present invention provide an endless array of textures, designs and colors. The composite material and the coloring of the composite material are generally water resistant or waterproof as a result of the coating of a water resistant or waterproof film such as an acrylic polymer medium. As discussed above, the composite material of the present invention can have the desirable look and feel of, for example, leather; but, compared to natural leather, the composite material of the present invention is much more flexible, easier to produce, less expensive to produce and easier to clean.

The composite materials of the present invention can be used in a wide variety of articles such as fashion accessories (for example, purses, jewelry, wallets, handbags and clothing), house-ware articles (for example, place mats, runners, tablecloths

and decorative frames) and packaging (for example, as a wrapping material). In general, the composite materials of the present invention are preferably used in a setting in which a decorative or fashionable fabric material is desirable.

Brief Description of the Drawings

5 Figure 1A illustrates a perspective view of the bottom of a base material.

Figure 1B illustrates a perspective view of the bottom of the base material of Figure 1A with a layer, film or coating of polymer medium solution that has been allowed to dry.

10 Figure 2 illustrates a perspective view of the top of the base material of Figure 1A with a coating of polymer medium on each side thereof.

Figure 3A illustrates a perspective view of a sheet of paper crumpled or wrinkled into a ball.

Figure 3B illustrates a top plan view of the sheet of paper of Figure 3A in a spread or generally expanded state to provide a textured sheet of paper.

15 Figure 3C illustrates a side view of the textured sheet of paper of Figure 3B in a spread or generally expanded state.

20 Figure 4 illustrates a perspective view of an embodiment of the present invention in which the textured paper of Figure 3B and 3C contacted with and bonded to the still wet second coating of polymer solution illustrated in Figure 2 to create a decorative layer thereon.

Figure 5 illustrates a perspective view of the top of the composite material of Figure 4B coated with a third layer or film of polymer medium solution.

Figure 6 illustrates a cross-sectional view of one embodiment of the composite material of the present invention as fabricated in Figures 1A through 5.

Figure 7 illustrates a front plan view of a handbag fabricated from the composite material of Figure 6.

Detailed Description of the Invention

As illustrated in Figures 1A through 6, the composite material of the present invention includes a base material 10 that is preferably first cut to a desired size. Base material 10 can, for example, be a woven material or a non-woven material. Preferably, the base material has a relatively hard finish and is generally non-stretchable (for example, preferably having an extensivity of no greater than approximately 5%; more preferably having an extensivity of no more than approximately 3%; and, most preferably, having an extensivity of no more than approximately 2%). If base material 10 is stretchable or elastic, the other layers of the composite materials must be chosen to prevent damage to the composite material upon stretching. Examples of suitable base materials 10 include, but are not limited to, non-woven facing materials and hard- or smooth-finish woven materials (for example, cottons such as chintz). Use of such a base material 10 allows use of a binder material such as an acrylic polymer medium 20 (for example, of the type typically used by artists) to bind to base material 10 and other materials such as, for example, a paper, a lightweight material or other decorative or textured material, layer or touch (as described in detail below). Base material 10 is preferably a relatively strong material after application of the binder material thereto (typically, in liquid form) in that base material 10 preferably resists tearing and other damage under the stresses experienced in application of other layers thereto as described below.

During production of the composite material of the present invention, base material 10 is preferably covered or painted (for example, with brush 30 or other suitable applicator) with a substance such as diluted polymer medium 20 as described above on one side thereof and allowed to dry to form a first layer or film 40 as illustrated in Figure 1B. Layer 40 preferably forms a protective layer over base material 10 and is preferably flexible (when dried or fixed) such that the flexibility of base material 10 is not

substantially impaired. Moreover, layer 40 is also preferably durable and water resistant or waterproof. As used herein, the term “waterproof” refers to a protective layer that is generally completely impermeable to or unaffected by water. As used herein, the term “water resistant” refers to a protective layer that repels water for at least a period of time and is inclusive of “waterproof” materials.

As discussed above, polymer medium 20, used, for example, by artists as a varnish over acrylic paints or as an additive to acrylic paints, is suitable for layer 40. An example of a suitable polymer medium of this type is the brand GOLDEN polymer medium, either gloss or matte (described, for example, www.goldenacrylics.com and available from Golden Artist’s Colors, Inc. of New Berlin, New York). Advantages in using such a polymer medium 20 include good bonding to the fabric, flexibility after drying, transparency, washability, wear resistance, dirt resistance, oil resistance, and water resistance or waterproofing.

Such polymer mediums typically comprise an aqueous acrylic polymer dispersion, that can, for example, be stabilized with ammonia. A coalescent such as a cyclic amide can be incorporated as well as well. As known in the art, acrylic polymer mediums can also contain anti-foaming agents, rheological agents, antifreeze and preservatives. Acrylic polymer mediums can be thinned with water. Another example of a suitable medium for use in the present invention as an bonding material and a protective coating is MOD PODGE, a water based, polymeric glue or coating, available, for example, from Dick Blick Art Materials of Galesburg, Illinois. Like acrylic polymer medium, MOD PODGE applies as a milky-colored liquid but dries to form a transparent coating.

The other side of base material 10 is also preferably coated with a substance that can act as a bonding material between base material 10 and a decorative/textured layer 60. In one embodiment, diluted polymer medium 20 forms a second polymer layer 50 thereon as illustrated in Figure 2. While this side of the base material 10 is still wet with the applied polymer medium 20, at least one decorative

and/or textured layer 60 including, for example, a sheet of textured paper, lightweight material or other decorative/textured layer or material, is applied to or pressed onto the polymer layer 50 as illustrated in Figure 4. The material of layer 50 must be adapted to securely bond decorative layer 60 to base material layer 10. Acrylic polymer medium 20 has been found to form an excellent bond between base material 10 and decorative layer 60. Decorative layer(s) 60 preferably provides texture, embellishment and/or ornamentation to the appearance of base material 10.

Decorative layer(s) 60 can be chosen from a wide variety of materials including, for example, white or colored calender or plate finish tissue paper like that used for wrapping paper or any non-woven material of similar weight and characteristics which can adhere to base layer 10 via a bonding medium (which is preferably transparent) such as polymer layer 50. Materials that are overly absorbent of the bonding medium (for example, creped paper or tissue) are preferably avoided, however. Absorbance of the bonding medium can cause poor adherence to base layer 10. For example, many woven materials are unsuitable because they absorb the bonding medium and thus do not adhere properly. However, a woven material with a dense weave and a smooth or hard-pressed finish, which reduces its absorbency, can be used.

As used herein (and generally in the paper and/or fabric industry), the term "calender" or "calendered" refers generally to paper or fabric which is made smooth and/or glossy by being pressed through rollers. For example, calendered tissue paper is a type of tissue paper often used to wrap packages or as filler in shoeboxes. As used herein (and generally in the paper and/or fabric industry), the term "plate" refers generally to a hot press of slick finish. As used herein (and generally in the paper and/or fabric industry), the terms "hard" or "hard-pressed" in reference to a finish refer generally to a calendar, flat, smooth, dense, hot press, tightly-woven, finish. Materials with a hard finish will not totally absorb a bonding medium such as acrylic polymer medium and thus allow some of the bonding medium solution to stay on the surface of the material to bond with another layer of material. Because non-woven material is formed by fusing strands of fiber under pressure, the finish is smooth and hard as a result of this pressure. In

general, woven fabrics having a thread count of over 180 threads per square inch and have been ironed or hot pressed smooth are considered to have a hard finish. Chintz and percale are examples of fabrics with a hard finish. Chintz has a smooth shiny finish on the face of the material and percale is very densely woven with a high thread count.

5 In the case that paper or other lightweight sheeting material is used in decorative/textured layer 60, the paper or other sheeting material can first be textured by, for example, wrinkling as illustrated in Figures 3A through 3C. While wrinkling of the paper, lightweight material or other decorative layer 60 is not necessary, it is desirable from the standpoint of producing texture or three-dimensional features, which add interest
10 and uniqueness to the finished product. The textured or three-dimension features of the decorative layer of the present invention are preferably sufficiently three-dimensional (for example, extending upward or downward from a generally horizontal plane) such that the texture is readily visible. Such texture can, for example, match the graining, nubbing and other textures common in natural materials such as leather and linen.

15 In addition, wrinkling can simplify the production process. For example, application of a wrinkled or textured material is relatively easily accomplished while application of a perfectly flat piece of paper or other material can be more time consuming and difficult during the manufacturing process. A generally randomly wrinkled paper can, for example, provide the appearance of natural leather products. The
20 type of decorative/textured material or layer 60 used is limited only by the imagination. Examples include tissue paper, leaves, grasses, string thread or lightweight facing material. A second decorative/textured material layer (not shown) and additional decorative/textured material layers can be added as well using the same or a similar process as described for decorative layer 60. Other layers of decorative material/binder
25 material are represented as layer 70 in Figure 6.

As illustrated in Figure 5, after application as described above, decorative layer 60 is preferably coated with a third film or layer 80 to form composite material 100. Third film or layer 30 preferably assists in fixing or binding decorative layer 60 to the

remainder of the materials. Third film or layer 30 is preferably flexible and adapted to exhibit the ornamental, textural features of decorative layer 60. In that regard, third layer, for example, preferably does not completely mask any three-dimensional nature or ornamental coloring of decorative layer 60. Third layer 80 is thus preferably a relatively thin layer of a translucent or transparent material. Third layer 80 is also preferably a protective layer that is water resistant or water proof when set or dried. Polymer medium 20 discussed above is a suitable material to form a third polymer layer 80. While polymer medium 20 of third polymer layer 80 is still wet, the material can be colored with, for example, paints or dyes as desired as represented by hatching lines 85 in Figure 5. Composite material 100 is then allowed to dry.

Before drying, acrylic polymer medium is typically a milky white color but dries to a generally invisible, transparent coating. As discussed above, acrylic polymer medium is available in both a gloss and matte finish and can be readily tinted to obtain, for example, a pearl, metallic or other effect. Unaltered acrylic polymer medium is translucent or transparent when dry, but if opaque paints or other colorants are added to the wet acrylic medium the translucence will be diminished.

Preferably, colorants used in the present invention are generally transparent. An example of generally transparent colorants are watercolor inks. Such watercolor inks and other generally transparent or translucent colorants can be used to color the material while retaining translucence of the binding medium. If decorative/textured layer 60 is a calender or plate finish tissue paper, either colored or white, the paper becomes almost transparent when the acrylic medium dries.

The consistency and viscosity of acrylic polymer medium (and other water-based or aqueous polymer coatings) varies by manufacturer. It is typically desirable to dilute acrylic polymer medium for ease of application and to control the penetration of the polymer medium into other layers of the composite material of the present invention for a good bond between such layers. An exact formula for dilution cannot be provided because of differences in types of acrylic polymer medium, but

attaining the desired consistency is well within the skill of one skilled in the art. In addition to the desirable features described above, acrylic polymer medium is latex free and is safe to use with people having latex-sensitive allergies.

As illustrated in Figure 6, a backing 90 such as woven sheeting fabric can optionally be fused to first layer 40 (using, for example, additional polymer medium 20 or other binder or adhesive material(s)) or attached via, for example, threading to create a composite material 100' for additional resistance to stress. An example of a suitable woven sheeting fabric is percale. Non-woven fabric may be used as a backing, but a woven fabric, with its criss-cross threading, is preferred as it is generally stronger and more resistant to stress.

As illustrated in Figure 6, composite material 100' of one embodiment of the present invention thus includes a base material 10 coated or covered on both sides with first and second polymer medium layers 40 and 50, respectively. On one side of coated base material 10, a textured paper, lightweight material or other decorative layer 50 is preferably attached via polymer medium 20 as a binding medium. Decorative/textured layer 60 is preferably sealed with a third layer or film 80 of polymer medium 20.

Figure 7 illustrates the use of composite material 100' in a handbag 200. As illustrated in Figure 7, a liner material 220 can be used on the interior of handbag 200 and also extend around the edges of composite material 100' of handbag 200. Backing 90 (see Figure 6) is particularly useful for adding strength in areas of stitching 210.

The weight of base material 10 and the type of optional woven backing 90 can be readily chosen to vary the weight and flexibility of composite material 100'. Extra layers of textured paper, lightweight material or other decorative layers/materials 70 and polymer medium solution or coloring can also be used to affect the weight and flexibility as well as the depth and surface texture of composite material 100'. The weight and flexibility of the material is thus a factor of the weight of the base layer, additional

decorative layers, and the concentration of the acrylic polymer medium. In general, more coatings of acrylic polymer medium will provide a stiffer material. The final use of the composite material determines desired flexibility and the number of layers. Color can also be added to film or coating 50 of polymer medium solution 20 on the top of base material 10 before decorative layer(s) 60 are added to increase the depth of color.

Although the present invention has been described in detail in connection with the above examples, it is to be understood that such detail is solely for that purpose and that variations can be made by those skilled in the art without departing from the spirit of the invention except as it may be limited by the following claims.

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